

What is claimed is:

1. A substrate processing method comprising the steps of:
placing a substrate in a processing vessel;
forming a film of a solvent over a surface of the substrate; and
dissolving a process gas in the film of the solvent.
2. The substrate processing method according to claim 1, further comprising the step of:
producing a vapor of the solvent in said processing vessel.
3. The substrate processing method according to claim 1, further comprising the step of:
producing a vapor of the solvent outside said processing vessel.
4. The substrate processing method according to claim 1, further comprising the step of:
purging an atmosphere in the processing vessel before said step of placing a substrate in a processing vessel.
5. The substrate processing method according to claim 1, further comprising the step of:
supplying a hot gas into said processing vessel to adjust a temperature of the substrate while the atmosphere in the processing vessel is being purged.
6. The substrate processing method according to claim 1, wherein the solvent is water, and the process gas is ozone gas.
7. The substrate processing method according to claim 1, wherein said step of forming a film of a solvent over a surface of the substrate includes the step of:
condensing a vapor of the solvent on the surface of the substrate.
8. The substrate processing method according to claim 7, wherein the step of condensing a vapor of the solvent on the surface of the substrate includes the step of:
adjusting a temperature of the substrate to a temperature lower than a dew point of the vapor of the solvent.
9. The substrate processing method according to claim 8, further comprising the step of:
supplying the vapor of the solvent into the processing

vessel after said step of adjusting a temperature of the substrate.

10. The substrate processing method according to claim 8, further comprising the step of:

supplying the vapor of the solvent into the processing vessel before said step of adjusting a temperature of the substrate.

11. The substrate processing method according to claim 9, wherein said step of adjusting a temperature of the substrate includes the step of:

heating the substrate.

12. The substrate processing method according to claim 11(13), wherein said step of heating the substrate includes the step of:

supplying a hot gas into the processing vessel.

13. A substrate processing method comprising the steps of:
placing a substrate in a processing vessel;
supplying a vapor of a solvent into the processing vessel;
supplying a process gas into the processing vessel;
producing a reactive substance by interaction between the vapor of the solvent and the process gas; and
processing the substrate with the reactive substance.

14. The substrate processing method according to claim 13, further comprising the step of:

pressurizing an atmosphere in the processing vessel.

15. The substrate processing method according to claim 13, further comprising the step of:

producing a vapor of the solvent in the processing vessel.

16. The substrate processing method according to claim 13, further comprising the step of:

producing a vapor of the solvent outside said processing vessel.

17. The substrate processing method according to claim 13, wherein said step of producing a reactive substance by interaction between the vapor of the solvent and the process gas includes the step of:

forming a mixed molecular layer of a mixture of molecules

of the solvent and molecules of the process gas.

18. The substrate processing method according to claim 13, further comprising the step of:

adjusting a temperature of the substrate to a temperature higher than a dew point of the vapor of the solvent and lower than a temperature of the vapor of the solvent.

19. The substrate processing method according to claim 13, further comprising the step of :

adjusting the temperature of the substrate to a predetermined temperature before said step of supplying a vapor of the solvent into the processing vessel.

20. The substrate processing method according to claim 19, wherein said step of adjusting the temperature of the substrate to a predetermined temperature includes the step of:

supplying a gas of a desired temperature into the processing vessel.

21. The substrate processing method according to claim 13, wherein said step of supplying a process gas into the processing vessel is executed before said step of supplying a vapor of the solvent into the processing vessel.

22. The substrate processing method according to claim 13, wherein the solvent is water, and the process gas is ozone gas.

23. The substrate processing method according to claim 18, wherein said step of supplying a vapor of the solvent into the processing vessel is executed before said step of adjusting a temperature of the substrate.

24. The substrate processing method according to claim 13, further comprising the step of:

purging an atmosphere of the processing vessel before said step of placing the substrate in the processing vessel.

25. The substrate processing method according to claim 13, further comprising the step of:

supplying a hot gas into the processing vessel to adjust a temperature of the substrate while the atmosphere of the processing vessel is being purged.

26. The substrate processing method according to claim 13, further comprising the steps of:

31. The substrate processing apparatus according to claim 29, wherein the substrate temperature controller includes:

a temperature adjusting gas supply section for supplying a gas of a regulated temperature into the processing chamber.

32. The substrate processing apparatus according to claim 31, further comprising:

a first discharge line for discharging the process gas and the vapor of the solvent supplied into the processing vessel out of the processing vessel; and

a second discharge line for discharging said gas of the regulated temperature supplied into the processing vessel out of the processing vessel.

33. The substrate processing apparatus according to claim 31, wherein said temperature adjusting gas supply section includes:

a gas supplying nozzle through which a temperature adjusting gas is ejected into the processing vessel.

34. The substrate processing apparatus according to claim 33, wherein said gas supplying nozzle is adjustable to change a gas ejecting direction of the gas supplying nozzle.

35. The substrate processing apparatus according to claim 33, further comprising:

diffusing plates for diffusing a gas ejected through the gas supplying nozzles.

36. The substrate processing apparatus according to claim 28, wherein said solvent vapor supply section includes a solvent vapor supplying nozzle for ejecting a vapor of a solvent into the processing vessel.

37. The substrate processing apparatus according to claim 36, wherein said solvent vapor supplying nozzle is adjustable to change a solvent vapor ejecting direction of the solvent vapor supplying nozzle.

38. The substrate processing apparatus according to claim 34, wherein said process gas supply section includes a process gas supplying nozzles for ejecting a process gas into the processing vessel.

39. The substrate processing apparatus according to claim

37, wherein said process gas supplying nozzle is adjustable to change a process gas ejecting direction of the process gas supplying nozzle.

40. The substrate processing apparatus according to claim 28, wherein the solvent vapor supply section has a solvent vapor generator disposed in the processing vessel.

41. The substrate processing apparatus according to claim 28, wherein the solvent vapor supply section has a solvent vapor generator disposed outside the processing vessel.

42. The substrate processing apparatus according to claim 41, further comprising:

a liquid trap for condensing a fluid produced by the solvent vapor supply section disposed outside the processing vessel and a fluid discharged from the processing vessel, to separate liquids contained in the fluids from gases contained in the fluids.

43. The substrate processing apparatus according to claim 28, further comprising:

a discharge line for discharging an atmosphere in the processing vessel from the processing vessel having a discharge rate adjuster for adjusting a discharge rate of the atmosphere.

44. The substrate processing apparatus according to claim 28, further comprising:

a drying gas supply system for supplying a drying gas into the processing vessel.

45. The substrate processing apparatus according to claim 28, further comprising:

a process liquid supply system for supplying a process liquid into the processing vessel.

46. The substrate processing apparatus according to claim 28, further comprising:

a second vessel provided adjacent to the processing vessel and defining a second processing chamber; and

a process liquid supply system for supplying a process liquid into the second processing chamber.

47. The substrate processing apparatus according to claim 46, further comprising:

a shutter interposed between the processing vessel and the

second vessel to separate the processing vessel and the second vessel from each other and to allow the processing vessel and the second vessel to communicate with each other.

48. The substrate processing apparatus according to claim 46, wherein said second vessel is disposed under said processing vessel, and a shutter is provided to openably partition said processing vessel and said second vessel with respect to a vertical direction.

49. The substrate processing apparatus according to claim 46, further comprising a substrate carrying system for carrying said substrate holding member between the processing vessel and the second vessel.

50. The substrate processing apparatus according to claim 46, further comprising:

a diffusion preventing box disposed below the processing vessel and the second vessel to prevent diffusion of discharged gases and drained liquids.